contrary, in Rivers, at any conſiderable diſtance from the Sea, the reſiſtance of the weight of the freſh Water, which is kept ſuſpended during the time of the Flood, is longer overcome by the more potent *Impetus* in the New and Full, than by the weaker in the Quadratures: and from hence this difference ſhould be ſtill more and more conſiderable as the Port is farther removed from the Sea.

A Demonſtration of the Velocity wherewith the Air ruſhes into an Exhauſted Receiver, lately produced before the R. Society *by Dr.* D. Papin. Reg. Soc. S.

THere being ſeveral Occaſions wherein it would be uſeful to know the Velocity of the Air, according to the ſeveral preſſures that may drive it; The Royal Academy at *Paris* hath attempted by ſome Trials to attain that Knowledge, and by means of a Bladder, which they did ſometimes fill up with Water, and ſometimes with Air; they found that (although the Weight to ſqueeze out theſe Liquors, and the hole to let them out were the ſame) nevertheleſs, the Bladder, when full of Air, could be empty'd in the 25*th.* part of the time that was required to ſqueeze out the Water of the ſame Bladder: from thence they concluded that the ſwiftneſs of the Air is 25 times greater than that of water, when both theſe liquors bare the ſame preſſure. This Experiment was very well thought on, and might ſerue till a better ſhould be found out; but thoſe Gentlemen could not but know, that this was not perfect: The Reaſon is that the Air yieldeth much, and ſo the Bladder being fill'd with it, will become pretty flatt, as ſoon as a conſiderable weight is layd upon it. It is plain therefore that the weight bearing upon a large ſpace doth not preſs euery part with the ſame force as it would do, if the Bladder did for a while remain Plump, as it doth when full of water: moreouer, the water it ſelf being heauy in the Bladder, makes ſome preſſure: ſo

that it appears, that the preſſure in this experiment was not quite ſo great vpon the Air as vpon the water : I haue therefore thought of another way, which I think better, to come to the ſaid Knowledge ; and I do humbly ſubmit itt to the *R. Society*.

My way is grounded vpon this *Hydroſtatical Principle, that liquors haue a ſtrength to aſcend as high as their ſource is* ; and although the reſiſtance of the *Medium* doth always hinder *Iects d'eau* in the open Air from reaching quite ſo high, neuertheleſs, the liquor at its firſt ſpouting out, hath the neceſſary ſwiftneſs to come to that height.

Propoſition I.

From this Principle may eaſily be deduced this Propoſition, that of two different liquor's driven by the ſame preſſure, that which is *in ſpecie* lighter muſt aſcend higher than that which is heauier, and their heights will be reciprocally in the ſame reaſon as their ſpecifick gravity's are. Thus, Quickſiluer being 13 times and a half heauier than water, beais as much preſſure when its ſpring is one foot aboue the ſpout hole, as water doth when it's ſpring is 13 foot and a half high, and the heigth to which Mercury ſhall aſcend will be 13 times and a half leſſer than the heigth to which water will be driven by thoſe equall preſſures.

Propoſition II.

From the foregoing Propoſition another may eaſily be deduced, *viz.* That of differing liquors bareing the ſame preſſure thoſe that are lighter *in ſpecie* muſt acquire a greater ſwiftneſs, and their differing Velocity's are to one another as the roots of the ſpecifick Grauity's of the ſayd liquor's.

For we haue ſeen *Prop.* 1. that the heigth's to be attain'd are in the ſame reaſon as the ſpecifick grauity's ; Now *Galileus, Hugenius*, and others haue demonſtrated that the Velocities

city's of bodies are to one another as the ſquare roots of the heigths to which they may aſcend: and ſo in this occaſion they are alſo as the roots of the ſpecifick Grauity's.

If therefore we would know what is the Velocity of Air being driven by any degree of preſſure whatſoeuer, we ought but to find what would be the velocity of water vnder the ſame preſſure: and then take the ſquare roots of the ſpecifick grauitys of theſe two liquor's; becauſe as much as the ſquare root of the ſpecifick Gravity of Water, doth exceed the ſquare Root of the ſpecifick Gravity of Air; ſo-much in Proportion will the velocity of Air exceed the velocity of water. For example, when I would compute what ſhoud be the ſwiftneſs of a bullet ſhott by the Pneumacick Engine, as hath been deſcribed in *Philoſophical Tranſaction, Num.* 179. I ſhould firſt compute what was the velocity of the Air it ſelf that droue the Bullet: I did therefore take notice that in this occaſion the Air bares a preſſure much about the ſame as that of water when it's ſpring is 32 foot high: now ſuch water would ſpout out with a ſufficient velocity to aſcend 32 foot perpendicular, and therefore, according to the rules and obſeruation of *Galileus*, *Halley* and others, ſuch water hath the velocity of 45 foot in a ſecond. It remains therefore but to know the proportion of the grauity of Air to that of Water: and we haue found it not to be always the ſame; becauſe the heigth, the heat, and the moiſture of the Atmoſphere are variable: neuertheleſs we may ſay in general that the reaſon between the ſpecifick grauitys of water and Air is much about 840 to 1. Taking then their ſquare roots, as I haue ſayd aboue, which roots are 29 and 1, we may conclude that the velocity of Air muſt exceed that of water by 29 times: and ſo multiplying 45, the velocity of water, by 29, we ſhall find that the velocity of the Air driven by the whole preſſure of the Atmoſphere, is about 1305 foot in a ſecond.

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